

A NEW GENUS AND SPECIES OF THE *DIEMENIA* GROUP (HEMIPTERA: PENTATOMIDAE: PENTATOMINAE) FROM AUSTRALIA, WITH CLADISTIC ANALYSIS OF SOME RELATED GENERA

I. AHMAD & S. KAMALUDDIN

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A new genus and species from 'Mt Emlyn', Australia, are described with special reference to their metathoracic scent auricles and male and female genitalia. The new taxa are compared with their closest allies of *Diemenia* Spinola, and *Niarius* Stål in the *Diemenia* group of Gross (1976) and a cladistic analysis of the related genera of the above group is presented.

I. Ahmad, Department of Zoology-Entomology University of Karachi, Karachi-32, Pakistan & S. Kamaluddin, Department of Zoology, Federal Government Urdu Science College, Karachi, Pakistan. Manuscript received 22 January 1988.

Gross (1976) described his *Diemenia* group with the characteristic feature of strigose vittae forming a curved line laterally on the abdomen on segments II, III, and IV, or II and III, or III and IV to accommodate aberrant groups like his *Boocoris*, *Alphenor* Stål and *Caridophthalmus* Assman along with *Diemenia* Spinola, *Niarius* Stål and *Aplerotus* Dallas and four others with five-segmented antennae. Ahmed *et al.* (1982) suspected that the strigose vittae which link the members of Diemeniini Kirkaldy or the *Diemenia* group are shared by the members of remarkably diverse groups. Earlier Bergroth (1905) also recognised two different patterns of strigose vittae, viz. arranged in a single straight row in the members of *Commisus* Stål and *Oncocoris* Mayr and in two or three irregular rows in *Diemenia* and *Niarius*. Gross (1976) also considered strigose vittae of *Caridophthalmus* species very different from those of *Boocoris*.

During a revision of *Niarius* and *Diemenia* (present authors in manuscript), we examined a male and a female specimen from 'Mt Emlyn', Australia by the courtesy of Dr A. Neboiss, Museum of Victoria. These looked intermediate between *Diemenia* and *Niarius* in the characters as noted under the following comparative note and cladistic analysis. The resemblance to the above two genera was so striking that the male was identified as *Niarius* or an allied new genus and the female as *Diemenia* (sp. nov.) by Dr G.F. Gross of the South Australian Museum, Adelaide. These are described below as *Grossimienia* with its type species *tuberculata* with special reference to the metathoracic scent auricles and male and female genitalia. It is compared with its closest allies *Diemenia*, *Niarius* and *Aplerotus*, and in the light of these characters a cladistic analysis of related genera of the *Diemenia* group is also presented.

For the examination of the male genitalia and especially for the inflation of the aedeagus, the techniques of Ahmad (1986) were used. For the

examination of the female genitalia and for descriptions, illustrations and for measurements the conventional procedures especially those used by Ahmad *et al.* (1982) were generally followed. All the measurements are in millimetres.

Genus *Grossimienia* gen. nov.

Type-species: *Grossimienia tuberculata* sp. nov.

Description

Coloration and general shape: Generally dark brown with ochraceous patches; elongate, covered with tubercles.

Head: Slightly longer than broad; eyes nonstylate, paraclypei shorter than clypeus, forming a lobe in front of the eyes; antecular distance much longer than remainder of head; antenniferous tubercles visible from above, laterally slightly projected and pointed but not spinously produced; antennae four-segmented, with 1st segment shorter than head, 2nd segment longest and much longer than 3rd; labium very long, reaching to 7th abdominal venter.

Thorax: Pronotum slightly more than 2 × broader than long, humeral angles sub-rounded, lateral margins serrate; scutellum elongate, much longer than broad; antero-lateral margins of corium crenulate, meso-sternum sulcate; metathoracic scent auricles spatulate, evaporating area distinctly rugulose; hind femora armed with several spines.

Abdomen: Connexiva exposed at repose; 3rd and 4th abdominal venter with strigose vittae.

Male genitalia: Pygophore quadrangular, lateral lobes large and narrowed at apex; paramere T-shaped; aedeagus with bilobed dorsal membranous conjunctival appendage, vesica short.

Female genitalia: First gonocoxae somewhat triangular; 9th paratergites triangular with apices narrowed, much shorter than fused posterior margin of 8th paratergites.

Etymology

The new genus is named *Grossimonia* in honour of Dr G.F. Gross, South Australian Museum, who originally recognised the taxon to be near *Diemenia* and *Niarius*.

Comparative note

Grossimonia is closely allied to *Niarius* in having only the connexiva exposed at repose and the outer lobe of the paramere small, and to *Diemenia* in having the lateral margins of the pronotum always serrate. It can be separated from both in having the body elongate, paraclypei shorter than the clypeus and labium very long, reaching to 7th abdominal venter.

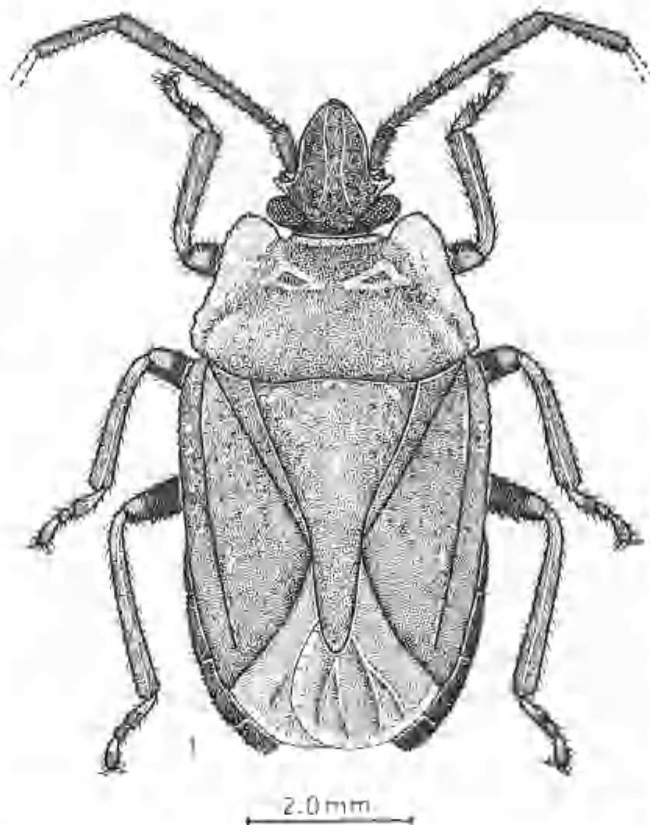


FIGURE 1. *Grossimonia tuberculata*.

Grossimonia tuberculata sp. nov.
(Fig. 1-6)

Description

Coloration and measurements: Dark brown except narrow lateral margins of paraclypei and lateral margins of pronotum; three basal spots on scutellum; apex of femora, basal portion of tibiae and tarsi, ochraceous; eyes blackish brown; ocelli brownish; membrane of hemelytra light brown. Total length male = 7.35; female = 8.45.

Head: Paraclypei with apex acuminate,

paraclypeal lobe just above the eyes prominent, lobe-like; antecular distance 1.15 (1.15-1.25) about or more than $2\frac{1}{2} \times$ length of remainder of head 0.4 (0.4-0.5); width of head 1.5 (1.5-1.76); interocular distance 1.0 (1.0-1.05), interocellar distance 0.5 (0.5-0.55); antennae with basal segment much shorter than head length and $\frac{1}{2}$ of 2nd, length of segments, I 0.55 (0.55-0.6), II 1.9 (1.8-1.9), III 1.1 (1.05-1.1), IV mutilated; labium with 2nd segment longest, 4th shortest, length of segments; I 1.4; II 1.6 (1.6-1.9), III 1.5 (1.5-1.6), IV 1.1 (1.0-1.1).

Thorax: Pronotum with anterior and humeral angles broad, length 1.5 (1.5-1.6); width 3.1 (3.1-3.4); scutellum laterally distinctly bilobed, apex acuminate, length 3.1 (3.1-3.7); width 1.9 (1.9-2.0); metathoracic scent gland ostiolar peritreme (Fig. 2) lobe-like, anterior margin sinuate, apex narrowed, acuminate, directed laterad; with spines; membrane of hemelytra shorter than abdomen; distance base scutellum-apex clavus 1.9 (1.9-2.1); apex clavus-apex corium 1.3 (1.3-1.7); apex corium-apex abdomen including membrane 0.9 (0.9-1.1); apex scutellum-apex-abdomen including membrane 1.2 (1.2-1.4).

Abdomen: Connexiva slightly exposed at repose; anterolateral margin of 7th abdominal sternum sub-rounded.

Male genitalia: Pygophore (Fig. 3) broader than long, dorso-median surface medially slightly produced and straight, ventro-posterior margin medially deeply inpushed, lateral lobes elongate with apex narrowed, lateral margins sinuate; paramere (Fig. 4) with inner arm broad, apex narrowed, outer arm curved, spine-like, outer margin sinuate; aedeagus (Fig. 5) with tips of bilobed dorsal membranous conjunctival appendage sclerotized, penial lobes large, plate-like, vesica not reaching fused margin of bilobed dorsal membranous conjunctival appendage.

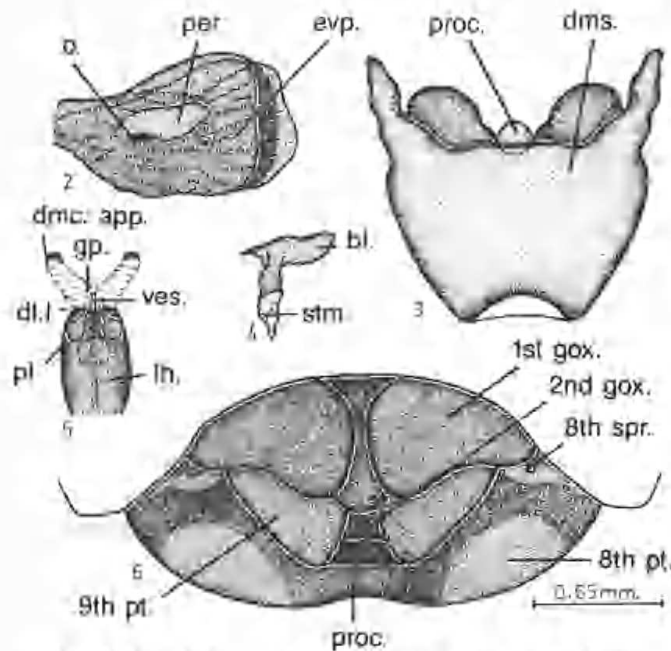
Female genitalia (Fig. 6): First gonocoxae large, plate-like, posterior margin distinctly sinuate; 9th paratergites elongate; posterior margin of fused arcus and triangulin convex; 2nd gonocoxae posteriorly concave; posterior margin of proctiger straight, fused posterior margin of 8th paratergites medially inpushed.

Material examined:

Holotype male, Australia 'Mt Emlyn' — Q, 12.5. 1937 in National Museum of Victoria. Paratype female, same data, in National Museum of Victoria.

Comparative note and etymology:

At present it is the only known species of *Grossimonia* gen. nov. but its tuberculate body, from which its name is derived, should isolate it in its genus.



FIGURES 2-6. *Grossimonia luberculata*: 2, metathoracic scent gland ostioles, ventral view; 3, pygophore, dorsal view; 4, paramere, inner view; 5, aedeagus, dorsal view; 6, female genitalia, ventral view. 1st gox. (first gonocoxae); 2nd gox. (second gonocoxae); 8th pt. (eighth paratergite); 8th spr. (eighth spiracle); 9th pt. (ninth paratergite); arc. (arcus); bl. (blade); dl. l. (dorsal-lateral lobe); dmc. app. (dorsal membranous conjunctival appendage); dms. (dorso-median surface); evp. (evaporatoria); gp. (gonopore); o. (ostile); per. (preitreme); pl. (penial lobe); proc. (proclitiger); stm. (stem); th. (theca); ves. (vesica).

CLADISTIC ANALYSIS OF THE TAXA INCLUDED

The present authors have recently completed (in manuscript) a revision of *Diemenia* and *Niarius*. Earlier (1982) they have also revised *Aplerotus* of this group. Gross (1976) has described with beautiful illustrations the genera of his *Diemenia* group. In this light a cladistic analysis of those genera of the *Diemenia* group which have four-segmented antennae is presented. In all, 27 characters, the polarities of which could not unreasonably be deduced, are analysed. No homoplasy had to be invoked.

Characters and Character States

1. *Body patterned* (a): Remarkably patterned body with a prominent transverse luteous stripe at about the level of the apex of scutellum in the members of *Aplerotus* is unique and it is certainly apomorphic, similar to the colour patterns encountered in strachiine Pentatomidae which is also an apomorphic condition.
2. *Body oblongate* (b): Pentatomidae are usually oval but elongate (e.g. *Mecidea* Stal) or oblongate (some halyine) - bodied species are very rare and

we consider this character of *Grossimonia* apomorphic.

3. *Lateral margins of head produced in front of eyes* (c): This appears to be a unique condition in the entire Pentatominae and is therefore certainly an apomorphy. In *Diemenia*, *Grossimonia*, *Niarius* and *Gilippus* species it is very small and lies just in front of the eye, but in *Alphenor* species it extends into an upwardly directed acute lobe lying from just in front of the eyes and thrown up into an erect triangular tooth-like process over the antennifers. The latter condition appears therefore to be a more derived state (c_2 in Fig. 7). In *Boocoris* and *Aplerotus* species this process appears to have been secondarily lost (c_3 in Fig. 7).

4. *Eyes stylate* (d): Throughout Heteroptera the eyes are usually nonstylate, but pedunculate eyes do occur independently in some groups of Trichophora such as in geocorine Lygaeidae, in some largiine Largidae and strachiine Pentatomidae. This condition is certainly apomorphic. *Boocoris* and *Aplerotus* species have slightly or distinctly stylate eyes and appear related, but remarkably pedunculate small eyes also occur in *Gilippus* sp. which appear to be its autapomorphy, but it must have been developed independently.

5. *Antennifers prominent* (e): In Pentatomoidea the antennifers are usually unspinose but in some groups of Podopini such as in *Stortheccaris* species, the antennifers are spinose and prominent which is their apomorphy. Similarly all the genera treated in the *Diemenia* group by Gross (1976) have prominent antennifers, mostly spinose, which reflects their synapomorphy but in *Alphenor* species each antennifer is produced into a cordate flat process which appears to be a further derived condition (e_2 in Fig. 7).

6. *Lunate patch in front of ocelli* (f): Unicolourous body is plesiomorphic and in this light the marked dark lunate patch in front of ocelli in *Diemenia* and *Niarius* species is apomorphic.

7. *Broad and medially notched apical margins of paraclypei* (g): In Pentatomidae the paraclypei are round or acute, but broad, truncate or medially notched paraclypei are extremely rare and therefore we consider it autapomorphy of *Gilippus* species.

8. *Antennae four-segmented* (h): In Pentatomoidea the occurrence of five-segmented antennae is very common and must be regarded as plesiomorphic. The occasional four-segmented antennae which occur in some halyines are considered neotenic and therefore apomorphic (Slater pers. comm.).

9. *Second antennal segment remarkably longer than each of the other antennal segments* (i): This is also an extremely rare condition in Pentatominae and probably represents synapomorphies of the presently treated genera (Fig. 7) following Ahmad & Afzal (1988).

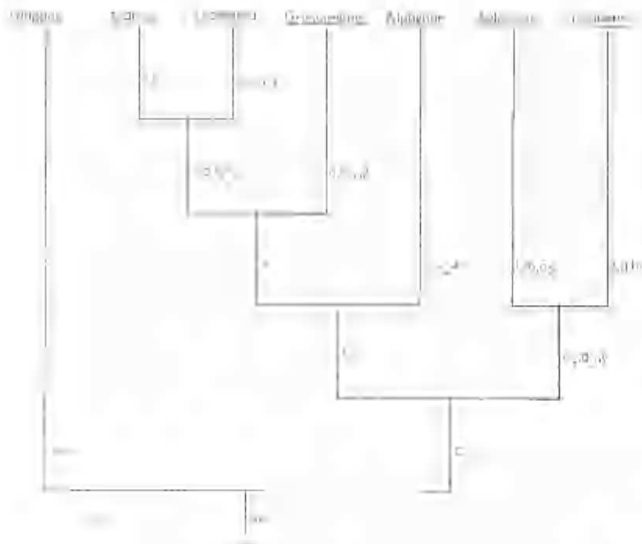


FIGURE 7. Cladogram of the genera included.

10. *Basal antennals clavate* (j): In Trichophora all antennals are usually cylindrical but in some groups e.g. *Mutusca* Stal of the Leptocorisinae and *Acestra* Dallas of the Microlytrinae of the Alydidae the basal antennals are remarkably clavate as is the apical segment in most of the Coreidae. This unusual condition reflects their apomorphy and this state in *Boocoris hufiformis* Gross also reflects its autapomorphy.

11. *Labium reaching seventh abdominal venter* (k): In Pentatomidae the labium usually reaches to the hind coxae but the remarkably long labium reaching to the 7th abdominal venter is certainly an apomorphic state in *Grossimienia*.

12. *Lateral margins of pronotum crenulate* (l): Smooth lateral margins occur in the majority of Pentatomidae bugs and where serrations are found, as in most asopine and halyine Pentatomidae, these reflect their apomorphies. Following this argument the presence of crenulations in *Niarius*, *Diemenia*, *Grossimienia* and *Aphenor* species reflects their synapomorphies but in *Apterotus* and *Boocoris* species the loss of crenulations is apparently a reversal of this character and therefore is considered here a further derived trait (l₂ in Fig. 7).

13. *Humeral angles produced* (m): In Pentatomidae humerals are usually rounded but in some groups such as the Asopini and the Halyini, the humerals may be spine-like reflecting their apomorphy following Schaefer & Ahmed (1987). In *Boocoris* sp. the basal third of the anterolateral margins of the pronotum are produced into a prominent, apically bifid, flattened process, arising from the disc and directed outwards at about 45°. The posterior process bordering the bifurcation is the shorter and conical part. This condition certainly represents the autapomorphy of the taxon.

14. *Presence of transverse spines on lateral margins of pronotum* (n): In the Pentatomidae the anterior angle of the pronotum is usually rounded but in most groups of the Phyllocephalinae it is pointed, which appears derived. In *Gilippus* sp. the anterior angles are produced laterally into pronounced transverse spines. Similarly, slightly above anterior to humeral angles on either side of marked acute projections in *Gilippus* sp. reflect autapomorphy.

15. *Scutellum markedly acuminate with posterior lobe remarkably narrow and elongate* (o): In the Pentatomidae the apical lobe of the scutellum is usually short and broad and this condition is plesiomorphic. In *Grossimienia* sp., however, the apical lobe of the scutellum is not only remarkably elongate but markedly narrow with apex acute. This condition is very rare and apomorphic.

16. *Fore-femora armed* (p): In many groups of Pentatomidae such as in most Asopini usually the fore-femora are spinose and this condition has also developed in some Lygaeoid, pyrrhocoroid and coreoid species. It certainly reflects the autapomorphy of *Aphenor* species.

17. *Hind-femora surpassing tip of abdomen* (q): In Heteroptera the legs are usually normal in size in proportion to the size of the body, but in certain groups such as in Gerridae and in some Alydidae, the hind legs are much longer than the abdomen with femur surpassing the tip of the abdomen. This is certainly their apomorphy. Following this argument this state in *Boocoris* sp. represents autapomorphy.

18. *Each connexivum bearing spine* (r): In Pentatomidae the connexiva are usually unspinose but in some pentatomids spinose connexiva are reasonably common (e.g. *Alcaeus* Dallas, *Diaphyta* Bergroth, *Morna* Stal, *Petalaspis* Bergroth and *Poecilometis* Dallas). In all these taxa this character (which could be of the same or different origin) appears to be apomorphic. In *Boocoris* sp. each laterotergite bears a strong backwardly-directed or reflexed spine which is unique in the entire group and is certainly apomorphic.

19. *Sides of tergites exposed* (s): In the Pentatomidae the connexiva are usually exposed at repose which is a plesiomorphic trait, but in *Diemenia* species not only the connexiva but the sides of tergites are also exposed, which is certainly an apomorphic state.

20. *Presence of strigose vittae* (t): Presence of strigose vittae is an unusual feature in the Pentatomidae. These are present in only a few groups such as the *Diemenia* group of Gross and in *Knightiella* Ahmad & Khan and *Mecidea*. In these genera they appear to be of different types but in every case they reflect an apomorphic condition.

21. *Median projection of Pygophore (u)*: The dorso-posterior margin of the pygophore in the majority of the Pentatomidae is smoothly concave. The prominent trilobed median projection in *Aplerotus* species certainly reflects the autapomorphy of the genus.

22. *Dorsolateral processes of pygophore prominent (v)*: These processes are usually rounded in the Pentatomidae but in some advanced Pentatominae, as in some halyines, these are prominent. In *Niarius* and *Grossimenia* species (and also probably in *Alphenor* species whose male genitalia are unknown), these processes are markedly prominent and elongate which condition represents their synapomorphy. In *Diemenia* species, however, these processes are remarkably elongate and apically curved. This feature represents a further derived state (v_2 in Fig. 7).

23. *Paramere with outer spine of the blade prominent (w)*: In the species of three genera viz. *Grossimenia*, *Niarius* and *Diemenia*, there is a spine on the outer surface of the blade which is very rare in the Pentatominae and represents synapomorphy of the group. In *Grossimenia* sp. the spine is transversely directed and is slightly below the level of the apex of the short blade which gives a T-like appearance to the paramere. In *Niarius* and *Diemenia* species the spine is arch-like and is at the level of the apex of the blade, which is a more derived character and gives it an L- or y- shape (w_2 in Fig. 7). In *Diemenia* species the spine is distinctly more pronounced and gives the paramere a y-shaped appearance, which is considered here to be further derived (w_3 in Fig. 7).

24. *Complex dorsal membranous and other sclerotised conjunctival appendages (x)*: The dorsal membranous conjunctival appendages in the majority of the Pentatomidae is simple, and bilobed as in *Niarius* and in *Grossimenia* species. In *Diemenia* species it is usually very complicated, many-branched and reflects autapomorphy. In *Aplerotus* species the presence of many sclerotised conjunctival appendages reflects a further derived condition (x_2 in Fig. 7).

25. *First gonocoxae concealing most of the remaining parts of ovipositor (y)*: In the Trichophora the genitalia are usually exposed but in the Pyrrhocoroidea these appear concealed, which condition was considered apomorphic by Ahmad & Schaefer (in manuscript). Following that argument the concealment of most of the ovipositor

by the first gonocoxae in *Niarius* species is certainly an apomorphic state.

26. *Spermathecal bulb markedly elongate (z)*: In the Pentatomidae the spermathecal bulb is usually oval or oblong, which condition reflects plesiomorphy, but in *Niarius* species the spermathecal bulb is usually elongate and slender which is certainly a derived state.

27. *Processes on the spermathecal bulb (aa)*: In primitive Pentatomoidea (Ahmad 1979) the spermathecal bulb is usually simple without finger-like processes but in some groups of advanced Pentatomidae such as in Carpocorini and Halyini, finger-like processes are present on the spermathecal bulb, which represents the apomorphic state similar to that in *Diemenia* and *Niarius* species. When the spermathecae of *Grossimenia* and *Alphenor* species become available they may also be found to possess these processes.

Discussion of Cladogram (Figure 7)

Gilippus (with five-segmented antennae) exhibits sister group relationships with the above genera of the *Diemenia* group (having four-segmented antennae) in possessing lateral lobes on the head in front of the eyes. The cladogram predicts that the spermatheca of *Grossimenia*, and also probably of *Alphenor*, will be found to possess finger-like processes on the spermathecal bulb.

The genera *Aplerotus* and *Boocoris* apparently form a group in exhibiting loss of the lateral process of the head in front of the eyes, and in the crenulation of the lateral margins of the pronotum. Similarly the eyes in both are on upwardly and slightly outwardly directed peduncles. In *Gilippus* species the eyes are also pedunculate, but here the eyes are small and the stalk appears more prolonged and must be considered of a different type.

The cladogram shows *Niarius*, *Diemenia* and *Grossimenia* closely related and *Alphenor* to exhibit a sister group relationship with these genera. The male genitalia of *Alphenor* are unknown but the cladogram predicts that when these become available they will be found to possess lateral lobes of the pygophore.

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REFERENCES

- AHMAD, I. 1979. A revision of the superfamilies Coreoidea and Pentatomoidea (Heteroptera: Pentatomomorpha) from Pakistan, Azad Kashmir and Bangladesh. *Ent. Soc. Kar. Suppl.* 1 (4): 1-113.
- AHMAD, I. 1986. A fool-proof technique for inflation of male genitalia in Hemiptera (Insecta). *Pakistan J. Ent. Kar.* 1 (2): 111-112.

- AHMAD, I. & AFZAL, M. 1988. A revision of Myrocheini Stal from Indo-Pakistan areas. *Oriental Insects* **23**:
- AHMAD, I., KHAN, N.A. & KAMALUDDIN, S. 1982. A revision of the genus *Aplerotus* Dallas (Heteroptera: Pentatomidae: Pentatominae) with description of a new species from South Australia. *Rec. S. Aust. Mus.* **18** (23): 513–518.
- BERGROTH, E. 1905. On stridulating Hemiptera of the Subfamily Halyinae, with descriptions of new genera and new species. *Proc. zool. Soc. Lond.* **2**: 146–154.
- GROSS, G.F. 1976. Plant-feeding and other bugs (Hemiptera) of South Australia. Heteroptera. Part II. Government Printer, Adelaide.
- SCHAEFER, C.W. & AHMAD, I. 1987. A cladistic analysis of the genera of the Lestenocorini (Hemiptera: Pentatomidae: Pentatominae) *Proc. Entomol. Soc. Wash.* **89** (3): 444–447.